

West River Water Chestnut Management Program

2007



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The Massachusetts Executive Office of Energy and Environmental Affairs

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Chapter 1: Description of the Blackstone River Watershed

The Blackstone River Watershed encompasses 540 square miles and stretches from the headwaters in Worcester, Massachusetts, specifically at the confluence of the Middle River and Mill Brook in Worcester, to its mouth at the Main Street Dam in Pawtucket, Rhode Island, where it becomes the Pawtucket River.

Steeped in cultural and natural history, the Blackstone River and its watershed encompass a wide variety of recreational and educational opportunities. The Blackstone River was the birthplace of the Industrial Revolution with the first textile mill in America. This was hardly the beginning of the River's place in human history. There were many Native American tribes that used the area and there are many tribes that still call the Blackstone Valley home. Western history in the area can be traced back to the 1600s.

The Blackstone River Watershed is as rich in natural history as it is in cultural history. Although the headwaters of the Blackstone River are located in an urban landscape, this River has abundant wildlife that live in and around its waters. Many species of trout make their homes in the cold water tributaries including some streams within the city limits of Worcester. Box turtles, spotted turtles, and wood turtles, each are species that are threatened in Massachusetts, can be found along the Blackstone River.

Birds often provide a good indication of the health and diversity of a watershed. The Blackstone River watershed has diverse habitats including grassland. Every year about a dozen breeding pairs of Grasshopper Sparrows breed in Worcester. Statewide there are about 300 breeding pairs, most living coastally. In addition we have many other key indicator species of birds including Black-crowned Night-Heron, Peregrine Falcons, Fish Crows, Northern Rough-winged Swallows, breeding Worm-eating Warblers, and breeding Orchard Oriole. The Valley is a major migration route for Common Nighthawks. This is a breathtaking sight with hundreds of birds gathering and circling in the air.

The Blackstone River Watershed Association:

The Blackstone River Watershed Association (BRWA) is the voice of the Blackstone River. We are dedicated to restoring, enhancing and preserving the Blackstone River system and its tributaries. You, your friends and neighbors all swim, fish, bird watch, boat, ski, and drink water in the Blackstone River watershed. We are working to improve the water quality, community stewardship of the river and improve the quality of life in our community.

For over 30 years, we have hosted an annual Canoe and Kayak race on the Blackstone River. This brings people to see the River as a source of nearby recreation. In addition, we also sponsor paddles at River Bend Farms during the summer to help new canoeists learn the art. We are also working to increase the number of safe public access points where people can put their canoes and kayaks in to the River. We believe that people will save what they love and we can help the see, and fall in love with the Blackstone River and its watershed.

The West River:

The West River is a tributary of the Blackstone River. This area is rich with native wildlife and scenic beauty. There are many places to swim, paddle or bird watch. There is a bird banding station on the West River – testament to the diversity of recreational uses and richness of the surrounding habitat. There are drinking water sub-watersheds and sensitive marshland habitats that are adjacent to the West River further restricting use and needing protection.

In spite of the West River being on MassDEP's 303d list, it is also on MassDEP's Coldwater Fishery list. This speaks to the importance of this habitat and as well as its fragility. A few degrees of temperature variation can be detrimental to coldwater fisheries.

The BRWA is working restore a portion of the West River in Uxbridge by removing Water Chestnuts. The West River is listed on the MassDEP 303d list (5131800) as a Category 5 water body – requiring a TMDL for problems with pH, organic enrichment/low DO, pathogens, metals, nutrients, and salinity/TDS/Chlorine. This project will help to mitigate the nutrient, organic enrichment and low dissolved oxygen in this section of the River. By removing excess invasive exotic plants, there will be less of an oxygen demand and nutrient load in that section. Water

Chestnuts are an annual plant. Since it is little used by wildlife, it dies off every fall in large quantities, creating a high nutrient load. It is considered a noxious weed that has little value to wildlife in this region and negatively impacts recreational use of infested water bodies.

This section of the West River did not have water chestnuts when it was reviewed for TMDL in the late 1990s. These aquatic invaders can grow quickly and the seeds stay viable for long periods of time.

Chapter 2: Current Pollution Issues on the Blackstone River

The Blackstone River's legacy of intense industrial development left its waters polluted and its course forever altered. The Blackstone River is considered the birthplace of the American textile industry in the early 1800's. Industrial activity and accompanying settlement left the river severely polluted with untreated sewage, detergents, solvents, heavy metals and other industrial wastes. The presence of numerous dams, canals and other human interventions means that little remains of its natural, free-flowing state.

Though much of the point source pollution has been discontinued, the non-point source or storm water runoff pollution remains an ongoing problem. Many communities are struggling to deal with storm water run off and this problem is increasing as more and more communities increase their impervious surfaces. In recent years, we have had major flooding incidents that have closed roads and businesses and caused hundreds of dollars in damage to infrastructure alone. The water just has no place to go.

As part of our historical mill town legacy, there are still several non-working dams along the Blackstone that once powered industry. These dams contained not only the River, but the sediments that cascaded along the riverbed. These sediments may be contaminated with old industrial waste. Removing these dams can have unintended consequences. Downstream locations would get exposed to the potentially contaminated sediment and wetlands that have grown up around impound dams may get drained of water. Yet removal of these dams is in our best interest in many cases to improve the water levels throughout the River and allow for more recreational opportunities.

The Blackstone suffers from a poor public image. Just as in the past people saw the River as a way to get rid of waste, now people see it as being smelly and polluted. The Blackstone's poor water quality is the greatest obstacle to promoting the River as a desirable recreational destination for visitors and residents alike, not to mention the damage the pollution has caused to the environment.

The West River:

The West River runs through Uxbridge Massachusetts and has been used by boaters, anglers, and swimmer for many years. Over the past few years, recreation has been decreasing due to excessive weed growth. Much of this weed growth is due to excessive nutrients in the West River. With excessive weed growth come other pollution issues like low dissolved oxygen and changes in the chemical composition of the water.

As discussed in the previous section, the West River is on the State of Massachusetts' 303d list of impaired waterways. This River is a Category 5 water body – requiring a TMDL for problems with pH, organic enrichment/low DO, pathogens, metals, nutrients, and salinity/TDS/Chlorine. Many of the pollutants are a combination of our industrial past and our current trend of sprawl. Impervious surfaces allow storm water run off to wash pathogens, nutrients, and salt right in the River without the benefit of being filtered through a wetland.

Chapter 3: Invasive Species

An invasive species is a non-native species that does harm to native species or causes economic harms. Aquatic invasive plants are any plant that grows in, around, or near a water body and that grow submerged or partially submerged. Invasive aquatic species are simply any plant or animal growing in an area where it is not native. These alien invaders often adapt to their new locale well in the absence of their natural predator or other normally occurring limiting factor. These species grow with out any of nature's checks and balances.

In the case of aquatic invasive species, many of the invaders out compete native species and contaminate waterways. Generally they grow more quickly than native plants thus reducing the oxygen and light levels in a given water body. Without their native predators, the plants often die out in vast quantities and decay using up the dissolved oxygen.

Many aquatic invasive species were planted on purpose. Many started out as nursery plants – some can still be purchased today. These plants are often bred and sold because they look good and can live with fairly low maintenance in a stressed environment, not because they are native plants. With the popularity of water gardens on the rise, this issue of non native species will only increase unless there is aggressive customer and seller education.

Some of our current invasive species either escaped downstream or were improperly disposed of by customers. Some plants, like *T. natans* were deliberately introduced without understanding the long-term consequences. Others, especially on larger ponds, lakes, and rivers, were introduced via watercraft. Many time plants become tangled in the propeller of a boat.

Commonly observed invasive aquatic species in the Northeast include Eurasian Milfoil and Purple Loosetrife. Although geographically still restricted to the northern portions of the east coast, Water Chestnuts are becoming more and more of a threat.

Chapter 4: Water Chestnuts

Water Chestnuts, or water caltrop (*Trapa natans*), are an aquatic plant that lives in slow moving nutrient rich waters such as ponds, lakes, impoundments, and slow moving rivers. This species of plant is wholly separate from the water chestnut (*Eleocharis dulcis*) whose root tuber we enjoy in Asian cuisine. *E. dulcis* is a sedge with a round tubers that are edible.

A caltrop was also a device with four points that was used in medieval times to pierce the hooves of enemy horses. A similar device was used in World War II to puncture tires. The derivation of caltrop is Latin and means thistle.

Trapa is the sole genus of the Trapaceae family and has recently been put classified as a subfamily of the superfamily. At present, there are only two members of the *Trapa* genus: *T. natans* and *T. bicornus*. *T. bicornus* is similar to *T. natans* in most respects and has only two horns on the nut rather than four. Lythraceae. Lythraceae is the same taxonomic family that includes Purple Loosestrife. These families fall under the Myrtales order that is a group of flowering plants and shrubs.

Water Chestnuts form a floating mat with their leaves that blocks the light and interfere with water navigation by aquatic animals, boats, and swimmers. The floating leaves of the Water



Water Chestnuts on the West River

Chestnut form a rosette with their oval shaped leaves. These leaves are smooth and glossy on the top and have fine hairs on the underside. The leaves below the surface are smaller and often fall off once the stem reaches the surface.

The seedpod of *T. natans* contains a single seed and has four horns on each side. The nut is hard and woody and turns dark brown when fully ripe. The seed is no longer viable once dry. In some parts of its native habitats of



T. natans seed pod

Eurasia, *T. natans* seed pods are cooked (boiled or roasted) and eaten. In the fall, the seeds drop in to the mud to overwinter. Most seeds will germinate within two years although some seeds can remain viable over a decade. Though many people think that these seeds travel on animals, it is more likely the empty seed pod that does. The pod floats when empty and retains the horns that attach easily to skin, feathers, clothing or other fabric, wood, and floating materials. It is considered unlikely that floating seed pods are the source of down stream outbreaks. More likely is that the full seed pods are carried along the bottom with current.

The flower develops early in the summer. The inconspicuous flower is white with four petals. When fully open, flowers are about eight mm across and tucked inside the leaf rosette. This plant is entomophilis, meaning that it is insect-pollinated.

Roots grow out of the stem where the submerged leaves detached. The roots are feathery in appearance and are fairly shallow. Because roots can grow out of the stem of the plant, the plant can colonize an area from floating rosettes of leaves though this is not the main method of reproduction in this plant. The shallow root system makes them ideal for hand harvesting.

Chapter 5: What will we monitor?

Water Chestnuts are easily identified by their leaf rosette and their distinctive seed pods. The sooner an outbreak is found and identified, the easier the eradication. We will use photographs to document the before and after level of plant material. The Contractor, who will mechanically harvest the plants, will also provide a photo record of the amount of biomass to be removed. They will place a scaled grid over the photograph to accurately estimate the pre-harvest level of Water Chestnut.



Water Chestnuts on the West River, Pre Harvest 2006



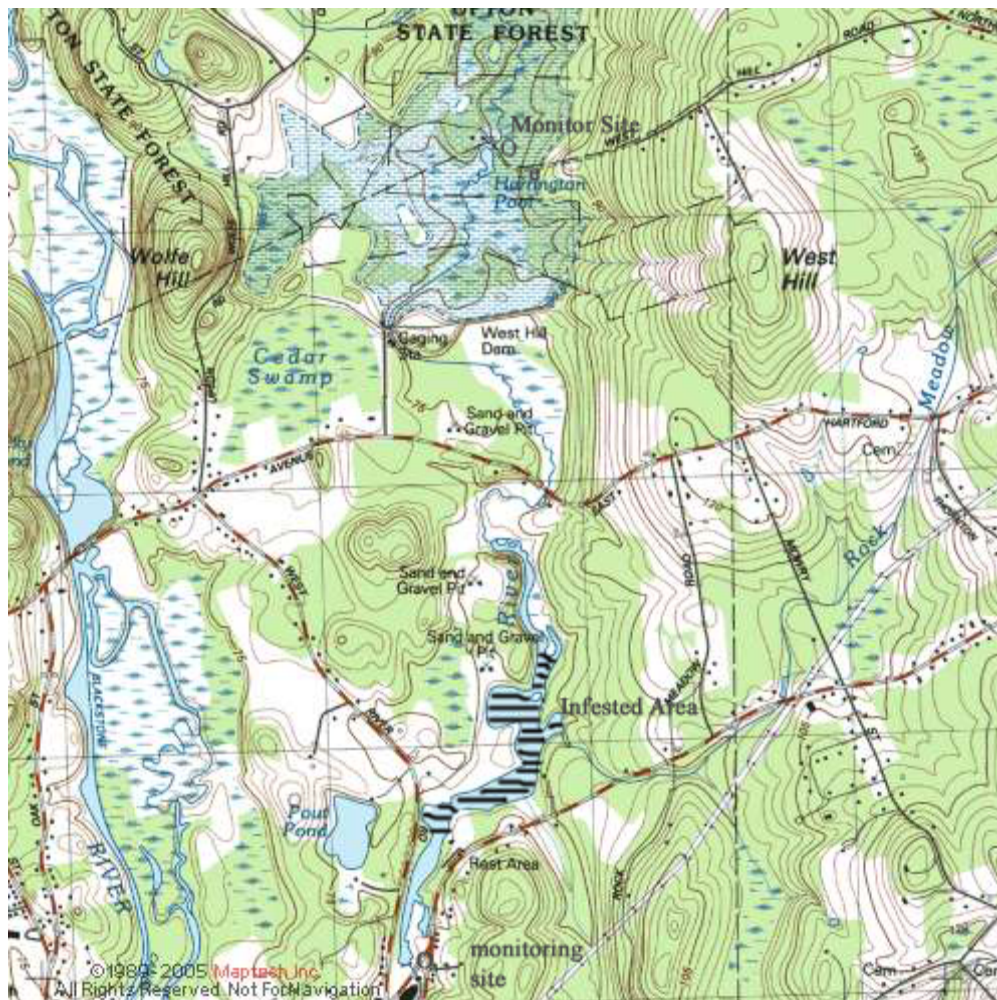
Same location after Mechanical Harvesting,

Volunteers Hand Pulling 2006

In accordance with an approved MassDEP-EPA QAPP, we will monitor the water quality before and after harvesting at two locations up and down stream of the Water Chestnut infestation. Volunteers will monitor water for aesthetics, temperature, dissolved oxygen, the percent of oxygen saturation and nutrient levels. This will give a good indication as to whether the

harvesting of the weeds will reduce nutrient levels and increase dissolved oxygen. If the biomass is allowed to decompose in the water, we would expect high nutrient levels and a low dissolved oxygen (DO) level – both situations being deleterious to native aquatic species.

The map below indicates where the Water Chestnut infestation is located. At the top of the map is the water quality monitoring site that is up stream of the weeds. At the center bottom of the map is the location of the down stream monitoring site.



Map of Infestation on West River in Uxbridge, MA.

Preliminary results indicate that the harvesting in 2005 and 2006 has had a positive effect on nutrient levels in the West River. In 2006, down stream of the harvest site, monitors reported a “Good” rating for nutrients where the prior year was “Fair.” There was no change in the nutrient

levels at the upstream monitoring site. In addition, the levels of dissolve oxygen (DO) seemed to improve. Levels improved at both sites in 2006 compared to 2005, but at the downs stream site, the improvement was more dramatic rising from a “Poor” in 2005 to an “Excellent” in 2006. Keep in mind, this is very preliminary data based on two data points. Both the harvesting and the Water Quality Monitoring are an on-going multi-year effort.

The Water Chestnuts will be taken to a composting facility dedicated to composting yard waste. This facility is maintained by the Uxbridge Public Works Department and is located well upland of any water bodies.



T. natans, Leslie J. Mehrhoff, University of Connecticut, www.forestryimages.org

Other Programs in Massachusetts:

The Connecticut River Watershed Association, in collaboration with the Riverways Program of the Department of Fish and Game and Environmental Law Enforcement, sponsored a Volunteer Invasive Species Monitoring Program. This appears to have been undertaken in 1999 through 2005. This program gave volunteers the tools needed to measure and report on outbreaks of specific invasive aquatic plants in the Connecticut River Valley. The watershed was divided into sectors and volunteers were asked to survey at least six water bodies in their sector by quantitatively documenting water chestnut abundance. Over 800 sites were surveyed throughout the watershed.

Once volunteers identified the water chestnuts, if the population was sparse, they were asked to hand pull them. Volunteers were asked to leave the plants on shore to dry.

Some of the places in the Connecticut River watershed where the hand harvesting program took place include Cove Island Cove, South Hadley; Vinton's Mill Pond, East Hartford; and Hockanum River, East Hartford. An overview can be found on their website. Retrieved June 10, 2007 from www.fws.gov/R5CRc/water_chestnut.htm. The program has been discontinued due to lack of funding.

Chapter 6: Water Chestnut Eradication Methods

There are many methods that are effective at reducing the population of Water Chestnuts including aquatic herbicide, mechanical harvesting, and hand harvesting. Biological controls of the Water Chestnut have been researched in the past, but a suitable control has yet to be found. Most of the effective insects were found to not only like to eat *T. natans*, but many other aquatic plants as well making not specific enough as a biological control.

The herbicide 2,4 – D is an effective means of controlling Water Chestnuts. This was most commonly used about 50 years ago when public perception of herbicide use was more positive and populations of *T. natans* were smaller. Aquatic herbicides are most effective in smaller, impounded waters, but can be an expensive and publically difficult undertaking in larger or riverine environments.

Drawdown can be quite effective at decreasing populations of Water Chestnuts. This method requires an impounded water body with a dam that can draw the water down completely to allow the seeds to dry or freeze. This method has a large affect on fish, amphibians and reptiles and should be undertaken with a great deal of caution. With seeds that can live up to 12 years, this method can be costly and detrimental to the whole watershed environment.

Mechanical harvesting is a cost effective and quick method to deal with large populations of Water Chestnuts. With this method, a large mechanical harvester scoops up the plants on a conveyer belt into the boat. The boat then transports the weeds to an onshore location such as a dumpster or dump truck. This method does have its drawbacks. Mechanical harvesters can only operate in deeper waters, they have the potential to damage sensitive habitats if there is a fluid or fuel leak, and they not only ‘harvest’ the plants of interest, but other plants, insects, fish and amphibians. Some of these can be returned unharmed to the water, but most are lost.

Mechanical Harvesting in the Blackstone River is planned for 2007.

Hand harvesting of the weeds is an effective and precise method for removal. Volunteers can target just the Water Chestnuts and because of their shallow root system, pull up the entire plant. The down side is that hand harvesting works best on shallow water bodies and with small populations of plants. Coordination of the volunteers by a professional is key so volunteers are most effectively managed and harvesting is done at the right time in the plant's life cycle.

Where we will Harvest:

We will work to remove Water Chestnuts on the West River near the Italian American Club. Please see the map on page 14. This area has access to the West River and has, in the past, been an access point for recreation. Due to the large mat of Water Chestnuts, that has been curtailed, but we are hopeful this area will be used by people wanting to boat and fish in the area.

Amount of Material Harvested:

We will use a scaled topographic map of the area and with planimetry, estimate the amount of biomass needing to be harvested. This method will be used by the Contractor hired to remove the weeds in conjunction with BRWA to accurately assess the amount of infested water.

To determine the weight of the harvested material we will rely on the experience of the Contractor and our own growing experience. Industry standards indicate that if Water Chestnuts are harvested early in the season at or just before flowering, a good estimate is 5 tons to an acre. Later in the season, the weight peaks at about 30 tons to acre in mid to late august after the flower is gone and the seeds are present. This is at best a moving target- an estimate.

For hand harvesting, we will estimate the weight by the volume. Each garbage bag filled will be counted as about 40 pounds. This estimate is in line with what is used in the Connecticut River Watershed as well.

Over the past two years, we have made estimates based on volume multiplied by Industry standards stated above. We also had additional input by the Uxbridge PWD based on the number of dump truck loads take to the composting facility.

Disposal of Plant Material:

The Uxbridge PWD will remove the Water Chestnut plant material from the pulling site and dispose of them at an upland Composting Facility. This facility is used for composting yard waste and is located at 80 River Road in Uxbridge. This location will keep the plants contained away from a water body while they fully dry. Once fully dried out, the seeds are no longer viable.

Permits Required:

Any work within 200feet of a river's edge needs to be approved by local and state authorities under the Massachusetts Rivers Protection Act of 1996. This law provides specific protections to riverine environments similar to the Wetlands Protection Act MGL Chapter 131 Section 40. Under this law, the BRWA applied to the MassDEP Division of Wetland Protection for a determination of applicability. This means that BRWA wanted to work within the protected area, but would not be changing the environment negatively. In 2006, BRWA was granted a "negative determination of applicability." This determination states that this work does fall under the River Protection Act, but since there will be no changes, alterations, removal, or filling in of the area, we are allowed to do the work. This meant that for the next three years, BRWA would be able to remove Water Chestnuts from the specified area of the West River.

Chapter 7: Volunteer Hand Pulling Program

Hand harvesting takes a fair amount of volunteer coordination as well as equipment. Typically a Volunteer coordinator will have to put out press releases to local newspapers. Here is a sample task list and time line.

Task	J	F	M	A	M	J	J	A	S	O	N	D
Coordinate Volunteers			X	X	X	X	X					
Harvest				X	X	X						
Compost				X	X	X						
Outreach			X		X	X	X			X		
Monitoring			X	X	X	X	X	X	X	X		

Coordinate Volunteers:

Currently we seek volunteers via press releases, notices in the BRWA newsletter in the spring, and via email to BRWA members. These volunteers are gathered on the shore of the West River and trained on the identification of Water Chestnut and proper removal. It is important to remove as much of the plant as possible. Timing is critical. The plants must be harvested when they are large enough to reach the surface of the water and before they set their seeds in late summer.

Harvesting and Composting:

Volunteers go out on the River in canoes or kayaks and pull the plants from the River bed and put them in laundry baskets or directly in their boats. When the baskets or boats are filled, the volunteers return to shore to dump them in a large dumpster.

Dumpsters are then taken to an upland location and the plant material is disposed of. The seeds, once dried out, are no longer viable. This has been completed by the Uxbridge PWD who have

provided the dumpsters and composting facility. The composting facility is used by residents for yard waste and is located away from any water body.

Environmental companies that are hired to complete harvesting at deeper locations do not need training on plant identification, but they should be monitored to ensure complete compliance with local rules and regulations. Not only are their operators human but regulations about disposal vary from location to location. Keep in mind that their machinery is large and needs adequate access to the water body.

How much can volunteers actually harvest?

In 2006, volunteers from BRWA harvested about a ton of weeds and the mechanical harvester did the rest. A report from the Connecticut River said they were able to hand pull over five tons of weeds but the time frame was not reported.



Here is an excerpt from October 2006 *Monitor*, the Newsletter of the BRWA:

*BRWA hired Lycott Environmental to mechanically harvest these invasive plants in most of the affected area. Lycott Environmental began the removal in late June, after the plants had sprouted, but before the seeds for next year's "crop" matured. The two mechanical harvesters finished harvesting the weeds in early August. When the job was done, **1200 TONS** of weeds had been removed.*

Many thanks to the 30 volunteers who came out on July 8 and July 22, 2006 to pull many of the weeds in the shallow areas, where the mechanical harvesters were not able to reach.

Thanks also go out to Wild Bird Gardens and the Friends of the Blackstone for donating the use of canoes, the Italian-American Club of Uxbridge for allowing the weeds to be dumped on their property, the Uxbridge PWD for supplying a dump truck and a driver to tote the weeds away, the

Massachusetts Department of Conservation and Recreation (DCR) and the National Park Service for their help with this project.

Outreach:

Outreach to the public is a key component to reducing future outbreaks of weeds. Both signage and brochures can be effective methods for educating people about Water Chestnuts. Signage should be located at all boat ramps and stations for washing boats should be available. Educating the public and nursery owners on native plant use and safe disposal of plant material is key to keeping new infestations from occurring and keeping current populations at a minimum.

Monitoring:

Water Quality monitors assess the 'aesthetics' of the water they are sampling. This includes information about water such as clarity, odor, erosion or litter at the sample site. A simple addition to the training would be introducing the line drawing of the Water Chestnut along with a photo of the leaves. If a Water Quality monitor sees the plant, they should note that on their data sheet and provide photo documentation if possible.

The results of water quality monitoring are available through the Blackstone River Coalition's website available at www.ZaptheBlackstone.org.

Chapter 8: Water Quality Monitoring (excerpt)

Throughout the watershed, volunteers will be testing the water quality of the main stem of the Blackstone River and its tributaries and conducting habitat surveys. All water quality monitoring is conducted in accordance with a MassDEP and EPA approved QAPP. From 9 am to noon, on the second Saturday of each month, between April and November, volunteers will collect grab samples for analysis of nutrient and turbidity content. In addition, they will be performing in situ tests of pH, dissolved oxygen, temperature and stream flow (if gage is present at site) and conduct annual habitat surveys.

Site selection is based on representative coverage of the watershed by sub-basins in both Rhode Island and Massachusetts and safe accessibility by volunteers. In some cases, monitoring efforts were also directed toward suspected problem reaches or reaches that were not covered by state monitoring efforts. The number of sites covered during a given year is dependent upon the number of available volunteers. Each of the watershed based groups (BHC, BRWA, and BRWC) cover a limited geographic area of the watershed based upon town boundaries and volunteer base. However, all of the above-mentioned groups have agreed to test for the same parameters and to follow the Standard Operating Procedures outlined in this QAPP.

The following is a list of parameters tested by the Volunteer Water Quality Monitoring Program. The chosen parameters reflect the goals of the BRC and what should be tested for the purposes of a general base-line survey since one objective of the monitoring program is to collect information in order to characterize basic conditions in the Blackstone River. Other than the habitat survey, which is performed annually, the remaining parameters in the list are performed on a monthly basis.

Listing and Reasoning for Parameters tested by Volunteer Water Quality Monitoring Program

Parameter	Purpose of Test
Dissolved Oxygen	Improve Water Quality - Certain river reaches are listed as impaired due to DO in state 305 (b) assessments. Sound Riverine Ecosystem—Low DO can result in stressful and even

	lethal conditions for aquatic organisms. Fluctuations in DO can help identify additional water quality problems.
Habitat Survey	<p>Aesthetics –The presence of riparian vegetation and bank stability can indicate an aesthetically pleasing river or stream.</p> <p>Improve Water Quality–Certain types of land use practices, bank stability and the presence of riparian vegetation can impact the quality of the water.</p> <p>Sound Riverine Ecosystem–The presence of suitable habitat for aquatic organisms can indicate the health of the river system.</p>
Nitrate-Nitrogen	<p>Improve Water Quality–Certain river reaches are listed as impaired in state 305 (b) assessments due to organic enrichment and excess algae growth due to nutrients. It may also lead to depressed dissolved oxygen, an impairment also listed in state 305 (b) assessments.</p> <p>Nitrogen sensitive embayments can be impacted by nitrogen loads from upstream sources.</p> <p>Sound Riverine Ecosystem–excess algal growth can disrupt life cycles of some aquatic organisms and disrupts the natural growth and decay cycles leading to collapse of a system. It may contribute to loss of benthic habitat and reduce light penetration. Eutrophication can lead to decreased biodiversity.</p>
Orthophosphate	<p>Aesthetics–Excessive phosphates in the water can increase plant growth (eutrophication) which can be considered unattractive and unsuitable for recreational use. It can also cause undesirable odors.</p> <p>Improve water quality–Certain river reaches are listed as impaired due to total phosphorous impoundments, organic enrichment and excess algae in state 305 (b) assessments. It may also lead to depressed dissolved oxygen, an impairment also listed in state 305 (b) assessments.</p> <p>Sound Riverine Ecosystem–excess algal growth can disrupt life cycles of some aquatic organisms and disrupts the natural growth and decay</p>

	<p>cycles leading to collapse of a system. It may contribute to loss of benthic habitat and reduce light penetration. Eutrophication can lead to decreased biodiversity.</p>
pH	<p>Improve Water Quality–Certain river reaches are listed as impaired due to pH in state 305 (b) assessments.</p> <p>Sound Riverine Ecosystem–pH can disrupt life cycles of some aquatic organisms and can also affect the solubility of some pollutants such as lead.</p>
Stream Flow	<p>Aesthetics–Low flow can lead to unattractive dry stream beds and unwanted odors.</p> <p>Improve Water Quality–Flow impacted by diversion, physical alteration or manipulation has reduced ability to assimilate pollutants. Reduced flow can result in increased water temperatures leading to reduced dissolved oxygen available to aquatic life.</p> <p>Sound Riverine Ecosystem–Reduced flow can result in increased water temperatures leading to reduced dissolved oxygen available to aquatic life. Natural flow regimes are important to maintain a diverse, functioning river system.</p>
Temperature	<p>Sound Riverine Ecosystem – Can help in the interpretation of water quality data such as determining percent saturation of oxygen.</p> <p>Currently, the river does not exceed warm water fisheries standards. There are 31 cold-water fishery resources in the MA portion of the watershed.</p>
Turbidity	<p>Aesthetics – Highly turbid water is usually considered unattractive and unsuitable for recreational use.</p> <p>Improve Water Quality - Certain river reaches are listed as impaired due to turbidity in state 305 (b) assessments.</p> <p>Sound Riverine Ecosystem – turbidity can disrupt life cycles of some aquatic organisms. It may contribute to embeddedness and loss of habitat, and reduced light penetration. Particulate matter in the water</p>

	column is often a platform for pathogens and nutrients. High turbidity may increase water temperature and decrease DO content.
Water Appearance	<p>Aesthetics – An undesirable appearance of the water, such as unpleasant odor, oily sheen, cloudiness, trash/debris, and/or presence of nuisance weeds, may be perceived as polluted and/or unsuitable for recreation.</p> <p>Improve Water Quality – Some water appearances can be indicative of water quality problems.</p> <p>Sound Riverine Ecosystem –Some appearances can reduce light penetration or prevent oxygen from dissolving in the water.</p>

One common purpose of testing for all of the chosen parameters is to educate the public. It is largely through education efforts that the general public will be able to understand the issues affecting the quality of the Blackstone River system. Volunteer efforts to check river sites on a periodic basis can also foster their sense of stewardship. By noticing unusual or inappropriate visual/odor cues, volunteers and the general public may be motivated to take action to address known or suspected problems.

Chapter 9: Evaluation of Success

There are two ways to measure success of the Water Chestnut Removal Program: 1) a reduction of weeds in subsequent years, and 2) improvements in water quality.

Documentation on the extent of Water Chestnuts on the West River before and after weed removal is important. This will allow a historical documentation of the effectiveness of the weed removal over time. An estimate will be made by environmental professions employed by a weed removal company. Additionally, photo-documentation by the BRWA will be made and posted on our website.

Many sources, including the US Fish and Wildlife Services, quote a 5 -12 year timeframe for weed removal and survey before a water body can be considered ‘weed free.’ This can be accomplished by hand pulling, herbicide application and mechanical harvesting or a combination of these methods.

Second, water quality data from up and down stream of the weed removal is a second key indicator of program success. Does the weed removal change (improve) the quality of the water down stream compared to both before removal and upstream of the removal site?

The West River has multiple sites surveyed as part of the Blackstone River Watershed-Wide Volunteer Water Quality Testing Program. This is a well-respected, long-standing volunteer program that has been testing water in the watershed for over 10 years. A MassDEP and EPA QAPP helps assure state, federal and local officials of the quality of the data gathered and subsequent analysis. We can ‘piggy-back’ on this program because they already have testing locations up and down stream of our Water Chestnut Removal Site on the West River.

Chapter 10: Sustainability of program

This project has been supported by the following grants:

- Greater Worcester Community Foundation (\$2,400, 2006-7)
- New England Grassroots Environmental Fund (\$2,000, 2006)
- Uxbridge Community Foundation/ Ocean State Power (\$8,000 2006-7)
- EOEEA (\$23,000, 2006-7)

Many businesses and organizations have helped to make this possible. They include:

- Italian American Club in Uxbridge – River Access
- Wild Bird Crossing – Kayak use, publicity, and volunteers
- Friends of the Blackstone – Canoe use and volunteers
- Uxbridge PWD – Pick up and upland composting of the weeds.

A project like this must be sustained for many years to keep an invader like this at bay. Although mechanical harvesting should be less and less of a need each year as hand-pulling becomes an adequate means of keeping up with the population this all takes funding. In 2006, the cash costs were about \$25,000 and 1200 tons of weeds were removed. The in-kind donations amounted to over \$20,000. Where are these funds to come from? How can this be maintained at a level adequate to keep the population of weeds small enough that hand pulling remains a truly viable option for management?

As with all fund-raising efforts, the larger the number and variety of funders the more stable the funding. This means that a program such as this needs to have more than foundation or state money to keep it functioning. The Blackstone River Watershed Association and other local organizations in the West River watershed will need to step up to the plate (cowboy up!) and commit funds on an annual basis to this program. In addition to BRWA, the Uxbridge Community Foundation, the Blackstone Valley Chamber of Commerce, and the Italian American Club are all impacted by recreation restrictions on the West River and may be able to contribute to the program on a regular basis.

Businesses can be reached through a presentation at the Blackstone Chamber of Commerce. The BRWA has a number of current board members who have completed Chamber sponsor leadership training and should be tapped to use their contacts to make a presentation. Some businesses that might be good choices to ask include Cove Insurance, Riverview Liquors, Shops at the Keka Monster, Unibank, Helen Fuels, E. O. Sterman Fuels, Foam Concepts, Koopman Lumber, Blissful Meadows, Bernat Mills, and Savers Bank. Organizations that should be tapped include: The Uxbridge Rotary, Uxbridge Women's Club and Blackstone Valley Sugaring Association.

Additional funding should be sought thru the MassDEP SEP program. The Supplemental Environmental Project program allows a company or person to fund a project that substantially benefits the environment in instead of paying a fine to the Commonwealth. In many cases, MassDEP requires that the SEP address the problem caused by the damage that incurred the fine and the SEP may provide greater benefit than simply cleaning up the violation.

There are six categories of SEP projects:

- Pollution Prevention

- Pollution Reduction

- Environmental Enhancement

- Environmental Education and Awareness

- Scientific Research, Monitoring, and Data Collection

- Emergency Preparedness and Compliance

A SEP could address multiple categories and should be discussed with MassDEP representatives prior to submission.

Chapter 11: Appendices

Press Release Sample

Local News Outlets in the Blackstone Valley

Bibliography

Blackstone River Watershed Association



PRESS RELEASE

FOR IMMEDIATE RELEASE

CONTACT: NICOLE WENGER @ 508-944-5886

Volunteers Needed To Help Pull Water Chestnut Weeds From
The West River in Uxbridge, MA

In the summer of 2005, the Blackstone River Watershed Association and several volunteers collaborated to manually extract Water Chestnut weeds from the West River in Uxbridge, MA. Water Chestnuts are a non-native invasive species, which deteriorates the health of rivers and restricts the amount of the recreational opportunities like boating and fishing.

This year, the Blackstone River Watershed Association was awarded a grant from The Massachusetts State Of The Executive Office Of Environmental Affairs and New England Grassroots Environmental Fund for the harvesting of this species. In mid June of 2006, Lycott Environmental, Inc, and the Uxbridge Department of Public Works are providing assistance in the mechanical harvesting of the plant. This effort will help control the invasion from continually spreading along the river.

While a majority of the harvesting will be carried out mechanically, remnants of the Water Chestnut weeds along the shoreline will need to be manually removed. On July 8th, from

8:00AM – 11:30AM, the Blackstone River Watershed Association is conducting a workday to clear the Water Chestnut weeds along the shoreline of the West River. So grab your gloves, rubber boots, canoes and kayaks and join us in protecting our community from the spread of invasive species.

If you are interested in volunteering or would like more information, please contact Nicole Wenger at 508-944-5886 or via email at www.thebrwa.org.

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Media Contacts in the Blackstone

Newspaper	Address	Town	Phone	Contact	Fax/Email
Auburn News	83 Southbridge St.	Auburn	(508) 832-2222	Ron McGilvary	(508) 832-2431
Blackstone Valley Tribune		Northboro	(508) 234-2107	Alleyne	(508) 234-7506
Grafton News	1 Hawthorne St # B	Grafton	(508) 839-2259		
Landmark	1650 Main St.	Holden	(508) 829-5981	Joanne Root	(508) 829-5984
Millbury-Sutton Chronicle	117 Elm St.	Millbury	(508) 865-1645	Andree Bellisie	milsutchron@charterinternet.com
Weekly Record	89 W. Main St.	Northboro	(508) 393-4601		
Worcester Telegram and Gazette	Offices in multiple towns				telegram.com
Worcester Business Journal				Christina Davis	cdavis@wbjournal.com This email address is being protected from spam bots, you need Javascript enabled to view it
Blackstone Daily News, Inc	23 Fay Mountain Road	Grafton	(508) 839-8885	Ellen Onorato	publishes Journeys, blackstonedaily@aol.com

Upton Mendon Town Crier	48 Mechanic St.	Upton	(508) 529-7791	Al Holman	thetowncrier@charter .net
Blackstone Valley Tribune	110 Church St, Whitinsville	Whitinsville	(508) 234-2107		
Country Gazette	159 S Main St	Milford	(508) 528-2600		
Community Advocate		Westborough	(508) 366-5500		Communityadvocate. com – has form for Press Releases
Blackstone Enlightener	96 Federal St	Blackstone	(508) 883-2840		Blackstonema.com
Vocero Hispano Newspaper	390 Main St # 947	Worcester	(508) 792-1942		VoceroHispano.com

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All illustrations are from BRWA materials, cited in the caption, or are open source and public domain works.

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